during the experiment are derived. A review of recent work on this difficult subject is appended to this paper.

(4) The last paper on our list deals with the egg of the mouse. By most observers the egg of this animal has been regarded as an exception to the rule that two polar bodies are formed during maturation. In order to clear up this point and to settle many other doubtful features of this egg, Prof. Mark and Mr. Long have undertaken an elaborate research involving the examination of 1000 eggs from 147 mice. The methods employed are given in welcome detail, and a special feature of the apparatus was a balance and recording drum so arranged as to indicate automatically the time of parturition. The histological results show that all mouse-eggs form two spindles and a first polar cell, and that all eggs on coming into contact with spermatozoa form a second polar cell. With regard to details, the authors conclude that the number of chromosomes is twenty. The chromosomes of the first spindle are "tetrads," and show indications of both transverse and of longitudinal fission, whilst those of the second spindle are "dyads," and divide longitudinally. The work is most carefully executed, and is fully illustrated, but the cytoplasmic structures are scarcely visible in the plates. The paper is one of great value to embryologists.

THE AMERICAN PHILOSOPHICAL SOCIETY.

THE annual general meeting of the American Philosophical Society was held at Philadelphia on April 20–22, and more than sixty papers on scientific and literary topics were presented.

It has been the custom for several years to devote one half-day session to a symposium on some special subject in science. This year the afternoon of April 22 was devoted to this feature, the topic being modern views of matter and electricity; and the following papers were offered:—The fundamental principles, by Prof. D. F. Comstock, of Boston; radio-activity, by Prof. B. B. Boltwood, of New Haven; thermionics, by Prof. O. W. Richardson, of Princeton; the constitution of the atom, by Prof. H. A. Wilson, of Montreal. The general conclusion seems to be that the atom of matter, groups of which compose the molecules of different substances, is built up of much smaller parts, called electrons, identical with the smallest unit of negative electricity. It was also explained how it is possible to estimate the actual number of electrons in any particular atom. As the inertia of an electron emitted from an atom of a radio-active substance, such as radium, has been experimentally proved to be a function of its speed, the evidence is strong that all inertia or mass may be electrodynamic in its nature.

Physiology.

The secretion of the adrenal glands during emotional excitement, by Prof. W. B. Cannon, Harvard University. The adrenal glands and the sympathetic nervous system are intimately related. The sympathetic system innervates the glands, and the glands in turn secrete a substance that affects bodily structures precisely as the sympathetic system affects them. The sympathetic system is aroused to activity in states of emotional excitement. Examination of the blood of excited animals reveals the presence of adrenal secretion, which was not found in the blood before the excitement. Possibly the adrenal secretion continues the excited state. Possibly also the adrenal secretion caused by emotional disturbances has some of the effects produced by injection of the substance, such as glycosuria and atheroma of arteries. Indeed, two of the author's students, Shohl and Wright, have recently shown that glycosuria can be produced in the cat by fright. The suggestion, however, must be put to further experimental test.

Coagulation of the blood, by Prof. W. H. Howell, Johns Hopkins University. The theory of the coagulation of blood most commonly accepted at the present time holds that three of the four necessary factors in the process are present in the circulating blood, but that the fourth, which initiates the process in shed blood, is furnished by the tissues outside the blood or by the disintegration of corpuscular elements in the blood itself. This fourth factor is an organic substance of the nature of a kinase, which, in conjunction with the calcium salts of the blood, serves to activate the prothrombin, also present in the blood, to thrombin. The thrombin then acts upon the fibrinogen and converts it to fibrin, which constitutes the essential phenomenon of clotting. In opposition to this theory, the author gave experimental evidence to show that in normal blood the fluidity is due to the constant presence of an antithrombin, and that in shed blood the tissue elements furnish a substance, thromboplastin, which neutralises the antithrombin, and thus allows clotting to take place. In the vertebrates below the mammals, the thromboplastin is furnished by the cells of the outside tissues, and without their cooperation clotting would not occur. In the mammals, thromboplastin is furnished by elements in the blood itself, the platetets, so that the blood may clot promptly without cooperation on the part of the outside tissues. In human beings, the condition known as hemophilia, in which there is delayed clotting and danger of fatal hæmorrhage, the defect is due, not to a lack of kinase in the tissues as a whole, the view usually taught at present, but to an excess of the antithrombin normally present in the blood.

The cyclic changes in the mammalian ovary, by Leo Loeb, director of the Pathological Department, St. Louis Skin and Cancer Hospital. In the mammalian ovary cyclic changes of a very far-reaching character take place. They concern the follicles, corpora lutea, and ova. There exists in the ovary a mechanism (in the corpus lutem) regulating those changes; the corpus lutem prolongs the sexual cycle, not by retarding the maturation of the follicles, but by preventing the rupture of the mature follicles. The author's recent observations make it very probable that a partial parthenogenetic development of some ova accompany those cyclic changes in the follicles in a certain percentage of animals.

Electrical Engineering.

The high voltage corona in air, by Prof. J. B. Whitehead, Johns Hopkins University. The author described the limitation to the long-distance electrical transmission of power imposed by the insulating properties of the air, and a new method for determining accurately a voltage at which the air in the neighbourhood of electric wires and cables will break down, and also gave the results of a series of experiments on the influence of the size of the wire, the stranding of the wire into a cable, the frequency, the pressure, the temperature, and the moisture content of the air. He also reviewed the bearing of present physical knowledge on the nature of the phenomena which are involved.

Geology.

Supposed recent subsidence of the Atlantic coast, by Prof. D. W. Johnson, Harvard University. The author briefly reviewed the evidence in support of the generally accepted theory that the Atlantic coast is subsiding at the rate of from 1 to 2 feet per century, and showed that the phenomena supposed to indicate subsidence might be produced by fluctuations in the height of ordinary high tides resulting from changes in the form of the shore-line. A study of the Atlantic shore-line indicates that conditions are there favourable to marked local changes in the height of the tides, independently of any general movement of the land. On the other hand, the structure of certain beaches along the coast afford very strong proof that there can have been no long-continued progressive subsidence of the coast within the last few thousand years. The theory of fluctuating tidal heights, and the theory of stability of the land mass, were illustrated by selected examples of shore-line phenomena.

Alimentation of existing continental glaciers, by Prof. W. H. Hobbs, University of Michigan, Ann Arbor. It was in the Alps of Switzerland that the early studies, and by far the larger number of subsequent investigations, of glaciers have been made. The Swiss type of glacier is one of the most diminutive, but as the theory of former continental glaciation was derived from these studies of puny glaciers, it is not surprising that their attributes were carried over unchanged to the reconstructed extinct types thousands, and even tens of thousands, of times larger,

© 1911 Nature Publishing Group

and this before any continental glaciers had actually been studied. The recent explorations of Norwegian, German, Swedish, and Danish explorers, but more than all of Peary in Greenland, and of Scott, Nordenskiöld, von Drygalski and others, but especially of Shackleton in Antarctica, have at last afforded us observations upon the existing continental glaciers. When these reports are carefully studied and compared, it is found that, as regards their form, their erosional processes, and especially their nourishment and waste, continental glaciers are as different as possible from those of the Alpine type. Instead of being nourished by snow precipitated from *surface* air currents, which are forced to *rise*, their snow supply is derived from the fine ice grains contained in *high-level* cirrus clouds which have been *drawn down* to the glacier surface, been melted, and there reprecipitated. This action is the work of a refrigerating air engine, which is developed directly by the snow-ice mass itself.

Front range of the Rocky Mountains in Colorado, by Prof. W. M. Davis, Harvard University. The front range of the Rocky Mountains in Colorado, now easily accessible by various railroad lines which enter and cross it from Denver and Colorado Springs, is an unusually fine example of a mountain highland, which in a former cycle of erosion was reduced to moderate relief, and since elevation to its present altitude has been submaturely dissected by its streams. The highland is surmounted by numerous hills and mountains of from 500 to 2500 feet relief, which represent the unconsumed residuals of the former cycle of erosion, and therefore presumably consist of the most resistant rocks of the region. The uplift of the mountain belt to its present altitude was not perfectly uniform, but arched gently from the plains westward; thus the crest of the range seems to correspond to the crest of the arched uplift. A notable feaure of the higher valley heads, among the surmounting mountains near the range crest, is the occurrence of numerous amphitheatres or cirques, and over-deepened valley troughs, the work of glaciers which for a moderate time, as geological time is reckoned, replaced the water streams in the highest districts. The contrast between forms due to ordinary or normal erosional processes and to glacial erosion is thus displayed with unusual clearness.

Astronomy.

An important astrophysical paper was presented on the solar constants of radiation, by Mr. C. G. Abbot, director of the Astrophysical Observatory, Smithsonian Institution, Washington. If we had no eyes we should still know of the sun by the feeling of warmth. The most exact measurements of the intensity of the rays of the sun, whether they be visible to the eye or affect the photographic plate or not, are made by an electrical thermometer called the bolometer. This instrument is so sensitive that a millionth part of a degree change of temperature is recorded by it. For seven years the bolometer has been used by the staff of the Astrophysical Observatory of the Smithsonian Institution to measure the solar constant of radiation. This constant represents the number of degrees (centigrade) which 1 gram of water would rise in temperature if all the solar radiation which could pass through an opening 1 centimetre square outside the earth's atmosphere, but at the earth's mean distance from the sun, could be used for one minute to heat the water. As all life, and almost all forces on the earth, depend on the supply of solar rays, the solar constant of radiation is at least equal in importance to the knowledge of the sun's distance.

The value of the solar constant was unknown within wide limits only five years ago. It is now believed to be within 1 per cent. of 1·93 calories per square centimetre per minute. Measurements made at Washington (sea-level), Mount Wilson (1 mile elevation), and Mount Whitney (nearly 3 miles elevation) agree in fixing this conclusion.

Nearly 500 determinations have been made. They indicate that the value is not really a "constant," but fluctuates about the mean just given within a range of 8 per cent. This conclusion means that the sun is a variable star. It is hoped soon to verify it completely, and it may prove for meteorology hardly less important than the determination of the mean value of the solar constant itself.

On the evening of April 21 Prof. Arrhenius, of Stockholm, gave an illustrated lecture on the physical conditions of the planet Mars. He directed attention to the many similarities between Mars and the earth which have caused some to think that Mars is inhabited, but gave it as his opinion that later investigations are not favourable to this view.

At the executive session on Saturday, April 22, the following new members were elected:—*Residents of the United States:* Dr. G. A. Barton, Bryn Mawr, Pa.; Dr. B. B. Boltwood, New Haven, Conn.; Dr. Lewis Boss, Albany, N.Y.; Dr. J. M. Clarke, Albany, N.Y.; Dr. W. M. Late Coplin, Philadelphia; Dr. J. Dewey, New York City; Dr. L. O. Howard, Washington, D.C.; Dr. J. P. Iddings, Chicago; Mr. Alba B. Johnson, Rosemont, Pa.; Dr. A. A. Noyes, Boston; Dr. G. H. Parker, Cambridge, Mass.; Mr. A. Lawrence Rotch, Boston; Dr. L. S. Rowe, Philadelphia; Dr. William T. Sedgwick, Brookline, Mass.; and Dr. A. Trowbridge, Princeton, N.J. *Foreign residents:* Prof. Svante Auguste Arrhenius, Stockholm; Prof. J. B. E. Bornet, Paris; and Sir John Murray, K.C.B., F.R.S., Edinburgh.

As has been customary, the meetings ended with a banquet at the Bellevue, Stratford, on Saturday evening, at which the following toasts were responded to:—"The Memory of Franklin," by President Schurman, of Cornell; "Our Universities," by Count von Bernstorff and President Hadley, of Yale; "Our Sister Societies," by Sir John Murray and Prof. W. M. Davis, of Harvard; and "The American Philosophical Society," by Prof. E. C. Pickering, of Harvard. Thus ended one of the most successful meetings in the history of the society.

Arthur W. Goodspeed.

PHOTOGRAPHY AN AID TO ASTRONOMY.[1]

In my address last year I endeavoured to put before you some of the problems which confronted the astronomer, and to illustrate the reasons why the most refined methods of physical measurement available were necessary in order to secure data for the solution of such problems. To-day I propose to deal rather with the methods in use, and the progress which has been, and is being, made in securing the necessary data for discussion, and in particular to sketch to you the advances which have been rendered possible through the introduction of photography as an aid. In these days, when portable hand cameras are accessible to everyone, when photographs can be taken by the mere expedient of pressing a button, leaving the manufacturers who supply the material to "do all the rest" at a trifling cost, or when even the processes of development can be performed by an inexperienced operator without the aid of any more elaborate equipment than a supply of fresh water, one is apt to forget how recent is the development of photography, not merely as a science or art in itself, but still more as a useful adjunct to almost every other branch of scientific investigation.

To appreciate the use of photography, try to imagine, if you can, a state of existence deprived of the sense of sight, not only in the individual, but throughout the human race. The phenomenon of light could doubtless still exist, and even be capable of exerting certain physiological action, but this phenomenon is one with which we are primarily cognisant through the direct physiological action on the optical nerves, and without which the intercourse of the individual with the external world is, perhaps, limited by the further senses of "sound," "touch," "smell," and "taste." All these senses, even including the first, are brought into operation only by closely adjacent surroundings, whereas the additional sense of sight, apart from its use as a means of communication between individuals, is the sole remaining sense by which we can obtain information regarding unexplored and otherwise inaccessible regions. I venture to doubt whether, under such conditions, the human intellect would have

---

[1] Presidential address delivered before the Royal Society of South Africa on April 19, by Mr. S. S. Hough, F.R.S.

© 1911 Nature Publishing Group